

ABSTRACT

Described herein is audio watermarking technology for inserting and detecting watermarks in audio signals, such as a music clip. The watermark identifies the content producer, providing a signature that is embedded in the audio signal and cannot be removed. The watermark is designed to survive all typical kinds of processing and malicious attacks. In one described implementation, a watermarking system employs chess spread-spectrum sequences (i.e., "chess watermarks") to improve the balance of positive and negative chips in the watermarking sequences. The balance is not imposed in an orderly fashion, which might make the watermark sequence more easily detectable to an attacker, but in a pseudo-random fashion. In that way, better sequence balance is achieved while preserving its randomness for an attacker without knowledge of the keys. In another described implementation, a watermarking system employs an energy-level trigger to determine whether to skip encoding of a portion of a watermark within a given time span of an audio clip. If a large discrepancy in energy levels exists over a given time frame, then the frame is not watermarked, to avoid audible time-dispersion of artifacts due to spectral modifications (which are similar to "pre-echo" effects in audio coding). In another described implementation, a watermarking system begins encoding of a watermark at a variable position after the beginning of an audio clip.